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VOL. I.—PART IV. FEBRUARY, 1904.

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With two plates and four illustrations in the text.

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GEORGE J. A. SKEEN, GOVERNMENT PRINTER, CEYLON.

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PREFACE.

THE issue of the first volume of a new periodical publication seems to require a few words of introduction by way of apology. It may appear rash or even reckless to launch a new journal upon the already crowded sea of scientific literature and thereby increase, though to an infinitesimal extent, the confusion of mankind. The experiment has nevertheless been sanctioned by Government, and it must be left to the future to decide with regard to its success or failure. Its justification will depend upon its success, and the latter will be determined not so much by the number of local subscribers as by the length of years during which it may be continued.

It will be seen from the nature of the contents of the first volume that "Spolia Zeylanica" contains matter of interest and intelligence to residents in the Island who are willing to give and take information of the kind vouchsafed to them in these pages. In a progressive Colony like Ceylon, where the aspect of the country is undergoing rapid change, records of apparently trivial observations often acquire a cumulative importance in the course of years, and it should be considered an advantage to have the means of rendering permanent and available for future reference, notes on the habits of creatures which become more shy and difficult to procure as time goes on and the new order of things replaces the old.

This is especially the case with those unapproachable people, the Veddas of Ceylon, and it is greatly to be hoped that those who have the opportunity of holding intercourse with this folk will rescue their vanishing traits from oblivion. A subject of this kind can never be exhausted, and the theory that the study of the manners and beliefs of primitive races belongs to the "history of the folly of mankind" has long been exploded. The same principle applies to the Rodiyas and the Gypsies and to all who hold aloof from the great game of destiny.

In addition to its function of conveying intelligence of local significance, this first volume is fortunate in having secured original contributions which constitute a distinct increase in our knowledge of the forms with which they deal. Other papers of an expert nature are in hand and will appear in the second volume. Of course it cannot be pretended that these articles will appeal very strongly to the personal proclivities of every reader of this journal. In such cases it can only be suggested that subscribers should rest content with the assurance that they are receiving good measure for their money and be satisfied with the crumbs which fall from the specialist's table.

The following libraries and bodies receive copies of "Spolia Zeylanica":—

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Kais. Akademie der Wissenschaften, St. Petersburg.

Zoological Institute, University of Tokyo.

ARTHUR WILLEY,

Director, Colombo Museum.

Colombo, January 2, 1904.

ERRATA.

Page 2.—Paragraph 2 : *for* "there is not even one peculiar Mammalian species" *read* "there are not more than two or three peculiar Mammalian species."

Page 8.—Footnote : *for* "Newton, A. A." *read* "Newton, A."

Page 18.—*For* "Mycalesis subdita" *read* "M. rama." *See* also page 71.

Page 65.—Line 2 : *for* "chafering" *read* "chaffering."

Page 78.—Paragraph 4 : *for* "Fregata aquila" *read* "F. ariel."

NEMATODA IN THE COLLECTION OF THE COLOMBO MUSEUM.

By Dr. O. von Linstow.

(*Göttingen.*)

With two Plates.

THE small collection of endoparasitic Nematodes here described contains representatives of twenty-two species, of which thirteen are new and one is made the type of a new genus, *Ctenocephalus*.

The following is a list of the species recorded, together with their hosts :—

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Ascaris.

The mouth is surrounded by three lips, of which the dorsal is placed symmetrically across the dorsal middle line, while the two ventro-lateral lips abut upon the ventral middle line: the

intestine is often prolonged into a cœcum, which lies below the œsophagus, and the latter frequently carries a tubular gland which rests upon the dorsal side of the intestine. The male possesses two equal spicula or cirri, but no bursa at the caudal end of the body.

Ascaris has the musculature characteristic of Schneider's Polymyaria, and belongs to the division Secernentes, in which the lateral fields or ridges are narrow and project well inwards; each ridge contains a canal, and the two lateral canals unite in front in the mid-ventral line, where they open to the exterior by a common *porus excretorius*, not far behind the mouth.

1.—*Ascaris rotundicaudata*, n.sp.

Pl. I., fig. 1.

Habitat: stomach and intestine of *Calotes ophiomachus* ("katussa," Sinh.), Colombo.

Cuticula annulate or transversely striate: lips broad and short, denticulate, without intermediate lips, papillæ set far back; dorsal lips nearly quadrilateral with rounded fore-edge, 0·22 mm. broad and 0·068 mm. long.

The œsophagus occupies $\frac{1}{26}$ of the entire body length in the male, $\frac{1}{24}$ in the female.

The male has a length of 46 mm. with a diameter of 0·73 mm. The tail is rounded with a conical extremity and equals $\frac{1}{58}$ of the body length. The cirri or spicula measure 8·8 mm.; at the tail end of the body on each side there are papillæ—thirty-one præanal papillæ and three post-anal. The præ-anal papillæ extend forwards to a distance of 3·2 mm. from the caudal extremity. Quite at the posterior end there is also a dorsal papilla.

In the female, with a length of 72 mm. and diameter 1·14 mm., the rounded tail occupies $\frac{1}{185}$ of the body length, and terminates in a fine conical prolongation. The vagina opens approximately in the middle of the body. The thick-shelled eggs are nearly spherical, 0·078 mm. in diameter; the shell surface is finely granulated.

2.—*Ascaris ceylanica*, n.sp.

Pl. I., fig. 2.

Habitat: (*a*) intestine of the Brahminy kite, *Haliastur indus*, Bodd., Colombo; (*b*) stomach of the fish eagle, *Poliaëtus ichthyaëtus*, Horsf., Kalpitiya.

This is a fairly large species, allied to *A. microlabium*, but not identical with it. All the specimens are fragmentary, so that measurements cannot be given.

Cuticula annulate; lips with large intermediate lips without denticulations (Zahnleisten); the inner pulp is produced forwards; the dorsal lip is 0·099 mm. broad, 0·073 mm. long; the tail end is conically attenuated.

The male is 1·22 mm. in diameter, the very short tail measures only 0·22 mm., the long cirri measure 5·53 mm.

The female has a diameter of 1·50 mm.; length of tail, 0·32 mm.; spherical thick-shelled eggs, 0·062 mm.

3.—*Ascaris brachyura*, n.sp.

Pl. I., fig. 3.

Habitat: intestine of *Calotes versicolor*, Dum. et Bibr., Colombo.

Cuticula broadly annulate; lips with tooth-rows, the denticles high and acute: intermediate lips absent; dorsal lip concave in front, 0·176 mm. broad, 0·097 mm. long; papillæ large, obliquely placed; body slender, tail very short and rounded; the œsophagus extends over $\frac{1}{14}$ to $\frac{1}{15}$ of the body length.

The male has a length of 31·6 mm. and a diameter of 0·91 mm.; the tail has a length equal to $\frac{1}{267}$ of the body, and carries a very fine style-shaped process; the falciform cirri have rounded ends and measure 0·62 mm.; at the caudal end on each side there are 22 præ-anal and two post-anal papillæ.

The female attains a length of 34·3 mm. and a width of 0·86 mm.; the tail is $\frac{1}{200}$ of the entire length, and is destitute of a styliform process at the end; the vulva lies somewhat in front of the mid-region of the body, dividing the latter in the proportion of 3 : 5; the reproductive organs leave the anterior third of the body free, and behind $\frac{1}{17}$; eggs were not mature.

4.—*Ascaris quadrata*, n.sp.

Pl. I., fig. 4.

Habitat: stomach of *Crocodilus porosus*, Gray, Bolgoda.

There is only one specimen in the collection, an immature female, but the formation of the lips is so characteristic, and diverges so much from that of the other Nematodes known from African and American crocodiles, that it is possible to diagnose the species.

The cuticula is finely annulate; lips without teeth and without intermediate lips; the dorsal lip is 0·132 mm. broad, 0·088 mm. long, quadrangular, with front angles rounded; the pulp (*pulpa*) is produced into two quadrangular projections. The length amounts to 15·8 mm., the diameter to 0·55 mm.; the œsophagus occupies $\frac{1}{4}$ of the entire length; a cœcum arises from the intestine

and extends forwards below the œsophagus, $\frac{2}{3}$ length of latter the short tail is conical, $\frac{1}{3\frac{1}{7}}$ of the body length.

The Ascaridæ hitherto known from crocodiles are as follows :—

Ascaris helicina, Molin ;* lips with intermediate lips, the pulp gives rise in front to two spheres with forked processes ; body spirally involute ; North America.

A. agilis, Wedl. ;† lips with dentigerous ridges (Zahnleisten), narrow at the base ; pulp with three roundish projections : body spirally involute ; Egypt.

A. lanceolata, Molin ;‡ lips with two semi-circular dentate ridges in front ; North and South America.

A. tenuicollis, Rud., from North and South America, has been so defectively described that it is impossible to recognize the species.

5.—*Ascaris mystax*, Zed.

Habitat : *Canis familiaris*, L. ; passed by a young sucking puppy, Colombo ; also from intestine of young *Felis pardus*, L., Wirawila.

Cf. A. Railliet, Traité de zoologie médicale et agricole, Paris, 1895, pp. 402–405, fig. 265.

6.—*Ascaris vitulorum*, Goeze,

= *A. vituli*, Neumann.

Habitat : *Bos indicus*, L. ; passed by a young calf of four to six months, Colombo.

Cf. G. Neumann, Revue vétérinaire, Toulouse, 1883, pp. 1–20, pl. III.–IV.

[Collected and presented to the Colombo Museum by G. W. Sturgess, Esq., M.R.C.V.S.]

PHYSALOPTERA.

Two lateral lips at the head end, surrounded by a circular cuticular sheath ; the musculature is of the type of Schneider's Polymyaria : the genus belongs to the Secernentes ; at the caudal extremity of the male there is a lancet-shaped or bean-shaped bursa ; the two cirri of the male are unequal ; on each side of the cloacal aperture at the tail end, four stalked papillæ, median and unstalked papillæ in varying numbers.

---

* *Cf.* v. Drasche, Verhandl. d. k. k. zool-bot. Gesellsch. Wien, XXXII., 1882, p. 120, tab. IX., fig. 9.

† Wedl, Sitzungsber. d. k. k. Akad. d. Wissensch. mathem. naturw. Classe. Wien, Bd. XLIV., 1861, p. 467, tab. I.–II., figs. 12–16.

‡ v. Drasche, *l.c.*, p. 133, tab. X., figs. 5–11.

7.—*Physaloptera varani*, Parona.

Habitat: stomach of *Varanus bengalensis* ("talagoya," Sinh.), Bolgoda. *Cf.* Parona, Elminti di Birmania, 1890, p. 776, tab. III., fig. 1.

8.—*Physaloptera*, spec.?

Habitat: intestine of *Calotes versicolor*, Colombo.

The collection contains only two specimens, which are not sufficiently well preserved to render a specific diagnosis possible.

Length 12·6 to 13·6 mm.; diameter 0·59 to 1·12 mm.; lips with three conical projections, of which the central is the highest and carries a tooth at its apex; the œsophagus is equal to $\frac{1}{5\cdot7}$ of the body length; the tail, rounded behind, $\frac{1}{16}$th of the entire length.

SPIROPTERA.

Head sometimes with two lips, sometimes with four, and sometimes with none; the musculature corresponds with Schneider's Polymyaria—Secernentes; male with two unequal cirri; the caudal papillæ are arranged in two longitudinal rows, and on each side there are four præ-anal papillæ.

9.—*Spiroptera dentata*, n.sp.

Pl. I., figs. 5–7.

Habitat: stomach of wild boar, *Sus cristatus*, Chilaw.

Cuticula finely annulate. The mouth leads into a vestibulum. 0·11 m.m. in length; its entrance is armed with a dorsal and a ventral tooth; the mouth is a transverse slit, the border of which shows, both above and below, three notches with papillæ. The œsophagus measures $\frac{1}{8\cdot6}$ of the entire length, and presents a spiral musculature; in a young worm of 14·6 mm. the nerve ring surrounds the œsophagus 2·64 mm. from the head end, and at a point situated 0·31 mm. behind it the *porus excretorius* opens.

The male (25 mm. long by 0·79 mm. broad) has a closely involute tail, which resembles that of *Spiroptera strongylina*, Rud.: the cirri are respectively 0·35 and 0·92 mm. long, the shorter one bearing at its end a barb. Immediately in front of the cloaca, on each side, there are four closely packed præ-anal papillæ; behind it there is one papilla, and all have long stalks; the cloaca is surrounded by a broad ring, notched externally; the bursa shows longitudinal rows of oval scales.

The female grows to a length of 55 mm., with a width of 1·10 mm.: the short conical tail is curved over the back; the vulva is placed far behind the middle, and divides the body in the

proportion of 70 : 23; the eggs are small, thick-shelled, and cylindrical, measuring in length and breadth 0·039 and 0·017 mm. respectively.

10.—*Spiroptera triangulum*, n.sp.

Pl. I., fig. 8.

From body cavity of *Calotes ophiomachus* ("katussa," Sinh.), Colombo.

One male specimen, 4·1 mm. long, 0·51 mm. broad; cuticula annulate; at the junction of œsophagus and intestine there is a deep circular constriction of the body wall.

The head is rounded, and presents on each side a triangular mark with a small papilla at the apex; the mouth leads into a small vestibule; the spicula (cirri) are sub-equal and measure 0·41 mm.; they are attenuated and pointed at the end, and show externally a reticulate design; the œsophagus is equal to $\frac{1}{7\cdot7}$, the tail to $\frac{1}{15\cdot3}$ of the entire length; the tail is flattened dorsally; on each side of it are four præ-anal and two post-anal papillæ; the former increase in size from before backwards, and the first post-anal papillæ are finger-shaped.

11.—*Spiroptera obtusa*, Rud.

From stomach of *Mus decumanus*, Pallas, Colombo.

See Von Linstow, Arch. f. microsc. Anat., Bd. 56; Bonn, 1900, pp. 363–366, tab. XV., figs. 3–4.

12.—*Spiroptera*, spec.?

From peritoneum of *Bufo melanostictus*, Schneider, Colombo.

A larva of 35 mm. by 1·18 mm.: head not distinct; reproductive organs not developed.

Stossich* describes under the name *Spiroptera bufonis* a larva from the peritoneum of the common toad (*Bufo vulgaris*), with a length of 44 mm. and breadth of 1 mm., which closely resembles the present example.

Heterakis.

Mouth generally surrounded by three lips; the musculature is of the type of Schneider's Polymyaria; the genus belongs to the Secernentes; caudal extremity of the male provided with a bursa, and in front of the cloacal aperture with a circular sucker, into which radial muscles are inserted; two unequal spicula.

* Boll. soc. Adriat., vol. XX., Trieste, 1900, p. 5, tab. II., figs. 14–18.

13.—*Heterakis trilabium*, n.sp.

Pl. I., fig. 9.

From the intestine of the jungle crow (*Centropus sinensis*, Illig.), Horana.

Cuticle annulate; three semi-circular lips at the head end, of which the dorsal lip carries two papillæ, the two others one papilla each; the œsophagus occupies $\frac{1}{13}$ of the total length. The male attains a length of 26 mm. and a breadth of 0·69 mm.; the conical tail is $\frac{1}{49}$ of the body length and carries on each side four large præ-anal and six post-anal papillæ. One pair of the latter occupies a sub-median position close behind the cloaca. In front of the latter there is a circular sucker. The cloacal aperture is triangular; the long sub-equal spicula measure respectively 1·95 and 1·97 mm.; their hinder end is rounded.

The female (39 mm. by 1·11 mm.) has a conical attenuated tail $\frac{1}{58}$ of total length, with small digitate prolongation; the vulva lies behind the mid-body, dividing the body in the proportion of 8 : 5; the thick-shelled smooth eggs are 0·081 mm. by 0·047 mm. broad.

14.—*Heterakis anomala*, n.sp.

Pl. I., figs. 10, 11.

From the stomach of *Tropidonotus piscator*, Schneider ("dia polonga," Sinh.), Colombo.

Cuticle annulate; head with three elongate, sinuate lips; at their base the cuticle is swollen, and presents transverse rings with distinct posterior margins; the œsophagus equals $\frac{1}{8}$ to $\frac{1}{9}$ the total length.

The male measures 34 mm. by 1·14 mm.; the caudal end is pointed and occupies $\frac{1}{43}$ of the body length; on each side there are three præ-anal and four post-anal papillæ; of the latter one pair lies close behind the cloacal orifice, and the next two pairs of lateral papillæ are remarkably large and touch one another; the sub-equal spicula are granulated and measure 1·70 and 1·75 mm; the sucker-like organ is beset with eight roundish projections, of which the cuticle shows pore canals.

The female is 33 mm. long by 1·14 mm. broad; the finely pointed tail is $\frac{1}{66}$ of the body length; the vulva opens at two-thirds of the length from the head end; the thin-shelled eggs measure 0·055 mm. by 0·036 mm.

Strongylus.

Body slender; the musculature is of the type of Schneider's Meromyaria, consisting of long rhombs generally arranged in six longitudinal rows; the genus belongs to the Secernentes; male

with two equal spicula ; a wide generally trilobed bursa at the tail end, supported by ribs ; the ribs of the bursa are muscular and terminate with a papilla ; head without buccal capsule, plainly rounded or with simple lips, frequently with six papillæ ; in the female the vulva lies behind the middle of the body.

15.—*Strongylus pigmentatus*, n.sp.

Pl. I., figs. 12, 13.

From stomach of hare, *Lepus nigricollis*, Cuv., Ranna, Southern Province.

This species is allied to *Strongylus retortæformis*, Zed.

The cuticle is annulate ; the head trilabiate, each lip carrying on its summit a small papilla ; the œsophagus occupies in the male $\frac{1}{14}$, in the female $\frac{1}{18}$ of the total length ; the tail is acuminate ; œsophagus, testes, uterus, eggs, and especially the ovaries are coloured black.

Size of the male 7·7 mm. by 0·12 mm. ; the spicula are short, 0·68 mm. ; they are pale brown, and have at the root a scutiform appendix ; they terminate behind in three branches, of which the largest is rounded, the others pointed ; the bursa has two strong lateral lobes and a very narrow median lobe ; the latter is supported by a rib which bifurcates, and each branch again divides into two branchlets which lie close beside one another ; the outer branches are the shorter ; the lateral lobes of the bursa are each supported by six slender ribs.

The female is 10·5 mm. long by 0·14 mm. broad ; the tail is $\frac{1}{66}$ of the total length ; the vulva is situated posteriorly, dividing the body in the proportion of 37 : 11 ; the eggs are 0·062 mm. long and 0·036 mm. broad.

The species differs from *Strongylus retortæformis*, Zed.,* in the formation of the head, the pigment, the cirri or spicula, and the position of the vulva. The spicula of *S. retortæformis* end in a point and are undivided and twisted ; the vulva of this species is only 0·75 mm. distant from the end of the tail, in contrast with *S. pigmentata*, where it lies 2·46 mm. from the caudal extremity, the two species being approximately equal in size.

Cylichnostomum.

Belongs to the Strongylidæ, Schneider's Meromyaria, and the Secernentes ; at the head there is a buccal capsule surrounded by two lateral and four sub-median papillæ, the lateral projecting freely above the cuticle ; the lumen of the capsule is lined by a

* See W. Stödter. Die Strongyliden in dem Labmagen der gezähmten Wiederkäuer. Hamburg, 1901, pp. 76–86, 92 ; tab. XI., figs. 6–8, tab. XII.

bacillary layer; the two halves of the male bursa are each supported by ten ribs, of which the second and third lie close together; the 8th, 9th, and 10th are ramifications of one rib.

16.—*Cylichnostomum tetracanthum*, Mehlis.

Passed by ponies on Iranativu; the animals succumbed to enteritis, anæmia, and exhaustion. Presented by G. W. Sturgess, Esq., M.R.C.V.S.

Syn. *Strongylus tetracanthus*, Mehlis; *Sclerostomum tetracanthum*, Wedl.; *Cyathostomum tetracanthum*, Molin.

See A. Looss. The Sclerostomidæ of horses and donkeys in Egypt, Cairo, 1901, p. 124, tab. IV., VI.–XI., XIII.

TRIODONTOPHORUS.

Strongylidæ, Meromyaria, Secernentes; large buccal capsule with six papillæ, two lateral and four sub-median; mouth surrounded by bristles; at the bottom of the capsule are three teeth; male bursa as in the preceding genus.

17.—*Triodontophorus serratus*, Looss.

From *Equus caballus*, L.; passed by ponies on Iranativu. Presented by G. W. Sturgess, Esq.

Cf. A. Looss, *op. cit.*, pp. 83–86, tab. III., figs. 31–38.

KALICEPHALUS.

Head with thick-walled chitinous mouth, laterally compressed, the wall traversed laterally by longitudinal tracts of parenchyma with a dorsal and ventral impression; œsophagus remarkably short and broad, the posterior half thickened to form a bulbus containing valves; the male bursa is broad and trilobed, the cirri are equal; lateral lines narrow and raised, with a vessel; vulva behind the mid-body; the genus belongs to the Strongylidæ, more particularly to the *Sclerostomina*, to the Meromyaria, and Secernentes. The species live in the stomach and intestine of snakes in South America and the East Indies.

18.—*Kalicephalus willeyi*, n.sp.

Pl. I., figs. 14–18.

From the stomach and œsophagus of *Vipera russelli*, Gray ("ticpolonga," Sinh.), Colombo and Weligatta; and from the intestine of *Coluber helena*, Daud., Horana.

The mouth cavity is large, compressed, and traversed by three paired parenchymatous bands ending in front in papillæ; there is a dorsal and ventral notch, rounded in front, acute behind;

the cuticle is smooth; the short œsophagus occupies in the male $\frac{1}{15}$, in the female $\frac{1}{22}$ of the body length; the posterior half expands to form a bulbus with valves; the nerve collar surrounds the œsophagus approximately in the middle at its thinnest portion; the *porus excretorius* discharges below the middle of the œsophageal bulbus in the female 0·39 mm. from the head end. Along the dorsal surface of the œsophagus occurs a gland, the duct of which lies at the dorsal side of the mouth opening; shortly before the orifice is reached the duct expands into a vesicle. The intestine has a thick lining membrane which is united with the outer or basement membrane on each side. The lateral ridges occupy the 10th part of the periphery of the body wall and project inwards far beyond the musculature; they are divided by a septum into a dorsal and a ventral half, and at the inner edge of the septum there is a canal with triangular lumen.

The material consisted of a very large number of females with only one male, which was 5·9 mm. in length and 0·33 mm. in diameter; the bursa is trilobed, the unpaired median dorsal lobe is supported by a forked rib, the inner fork again divides at the end; the lateral lobes have four ribs each, of which the anterior is double, while the others arise from a common root; the thin cirri measure 0·37 mm.

The female attains a length of 19 mm. with a breadth of 0·51 mm.; the vulva is circular and rather prominent, lying behind the middle, and dividing the body in the proportion of 18 : 5; the eggs measure 0·057 mm. by 0·036 mm.

The genus *Kalicephalus* was established by Molin,* who described seven species from Brazil, of which one was figured, viz., *K. inermis*. One of Molin's seven species, *K. appendiculatus*, was subsequently re-discovered by Stossich,† who also described an eighth species under the name *Strongylus ersiliæ*,‡ from the Indian *Python molurus*. The species here described is therefore the ninth of the genus.

Oxyuris.

Belongs to the Meromyaria and the Secernentes. The œsophagus is long, terminating in a bulbus containing valves; male with one cirrus; frequently three papillæ on each side of the tail; female with long acuminate tail; eggs generally asymmetrical; the species live in mammals, amphibia, reptiles, insects, and myriopods.

* Il sottordine degli Acrofalli. Mem. Ist. Venet., vol. IX., Venice, 1861, pp. 114–125, tab. VII., figs. 1–3.

† Boll. Soc. Adriat., vol. XX., Trieste, 1900, pp. 2, 3, tab. I., figs. 7, 8, tab. II., fig. 9.

‡ *Ibid.*, vol. XVII., 1896, p. 124, tab. IV., figs. 11–13.

19.—*Oxyuris poculum*, n.sp.

Pl. II., figs. 19–21.

Passed by ponies on Iranativu. Presented by G. W. Sturgess, Esq., M.R.C.V.S.

This species is nearly related to *Oxyuris curvula*, Rud., having the same form as the latter; the mouth is hexagonal with two large lateral papillæ in contradistinction to the six papillæ of *O. curvula*; the œsophagus in the male occupies $\frac{1}{7\cdot7}$ of the total length, terminating in a bulbus; the ducts of the three œsophageal glands lie quite anteriorly in the lumen of the œsophagus, and are cup-shaped with denticulate margin, whereas in *O. curvula* they are tubular.

The male is 14·2 mm. long by 0·99 mm. in diameter; the cirrus is 0·44 mm. long, finely acuminate; the tail carries four papillæ, of which two lie at the posterior angles of the quadrangular portion of the body and two are placed ventrally. The six median papillæ of *O. curvula* are absent in the present species.

The female has a long filamentous hind body, and attains a length of 65 mm. and breadth of 2·57 mm.; the eggs have a double shell; the outer shell is perforated at one pole, the orifice being closed by a plug; the eggs measure 0·081 mm. by 0·047 mm., those of *O. curvula* being 0·099 mm. by 0·042 mm.

20.—*Oxyuris acanthura*, n.sp.

Pl. II., fig. 22.

From rectum of *Calotes versicolor*, Dum et Bibr., Colombo.

Head rounded, without lips and papillæ; the œsophagus is long and narrow, ending behind in a strong bulbus; in the male it is $\frac{1}{4\cdot5}$ of the total length, in the female $\frac{1}{4}$; the intestine is wider than the œsophageal bulb; the cuticle is deeply ringed.

The male (2·29 mm. by 0·37 mm.) has a rounded tail end with a curved process bearing on each side one papilla, while the body has two papillæ on each side; the cirrus measures 0·065 mm.

The female is 5·84 mm. long and 0·55 mm. broad; the rounded tail, $\frac{1}{15}$ of the body length, ends with a style-shaped process; the vulva lies behind the mid-body, dividing the body in the proportion of 7 : 5. Eggs were not mature.

The species has affinity with *Oxyuris brevicaudata*, Duj., from *Ascalobotes fascicularis*. Parona* refers to an unnamed *Oxyuris* from *Calotes*, spec., with a length of 20 mm., the vulva opening in the anterior third of the body.

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* Elminti di Birmania. Ann. Mus., Genova, ser. ii., vol. VII., 1890, p. 771.

CTENOCEPHALUS, n.g.

At the head end a dorsal and a ventral erectile lip, whose end lobes interdigitate; four cervical glands with two orifices in the dorsal lip; cephalic cuticle thickened like a turban with transverse grooves; low and narrow lateral lines without vessel; excretory pore absent; two equal cirri; belongs to the Polymyaria and Resorbentes.

21.—*Ctenocephalus tiara*, Von Linstow.

Pl. II., figs. 23–27.

From stomach of *Varanus bengalensis*, Daud. ("talagoya," Sinh.), Bolgoda, and from stomach of *Varanus salvator*, Gray ("kabaraguwa," Sinh.), Horana.

I described this species in the year 1879 under the name *Ascaris tiara*.† I now perceive that it must form the type of a distinct genus. The original specimens were taken from the Natal monitor, *Varanus ornatus*, Daud.

The formation of the head is very remarkable, comprising a dorsal lip with three rounded projections and a ventral lip with four similar processes, interdigitating; the lips can also separate from one another and be erected; in their hinder portion there are four club-shaped glands with round lumen, reaching backwards 0·2 mm.; outwardly the glands are furnished with spiral muscles; the two glands on the right and left side, respectively, unite into a common duct, and both ducts (right and left) open to the exterior on the dorsal lip; the cuticle is deeply grooved at intervals of 0·088 mm.; the œsophagus measures $\frac{1}{3}$–$\frac{1}{4}$ of the total length; the tail is conical; dorsal and ventral tracts narrow; the lateral tracts ("Seitenfelder") are broad and low, and do not project inwards beyond the musculature; they occupy, on each side, $\frac{1}{8·7}$ of the periphery of the body; a septum divides them into dorsal and ventral halves, but there is no vessel and consequently no *porus excretorius*.

The worms had bored with their heads deep into the wall of the stomach, which had grown firmly round them; the nutrition, therefore, cannot take place through the mouth, but evidently, as with Filaria and all other Resorbentes, through the cuticle; the lateral fields appear to play the part of absorbing organs.

The male is 18–20 mm. long and 0·63–1 mm. in diameter; the tail measures $\frac{1}{35}$ of the total length; the two falciform cirri have pointed ends and a length of 1·6 mm.; there are on each side of

† Württemb. naturw. Jahresh. Jahrg., XXXV., Stuttgart, 1879, p. 320, tab. V., fig. 1.

the tail two præ-anal, one large par-anal, and three post-anal papillæ.

The length of the female amounts to 25–28 mm., with breadth of 1·2–1·3 mm.; the tail measures $\frac{1}{46}$ of the length of the body; the vagina opens behind, dividing the body in the proportion of 50 : 11; the eggs are 0·065 mm. by 0·042 mm. in size; they have thin shells, and their surface is beset with fine granulations.

Filaria.

Belongs to the Polymyaria and the Resorbentes; elongated Nematoda: low and broad lateral fields, which generally occupy $\frac{1}{6}$ of the circumference of the body; excretory pore absent; caudal end of the male generally spiral; two unequal cirri; at the tail end two rows of papillæ, on each side four præ-anal; in the female the vulva lies quite in front.

The species occur in Vertebrata, especially mammals and birds, in all organs except in the digestive tract.

22.—*Filaria vivipara*, n.sp.

From the peritoneum of *Corvus splendens*, Vieillot, Colombo.

The material only contained females, 16–21 mm. long and 0·32 mm. broad; the œsophagus measures $\frac{1}{28}$, the tail $\frac{1}{85}$ of the total length; the generative orifice lies in front 1·5–1·8 mm. from the cephalic extremity; the eggs with membranous chorion measure 0·039 mm. by 0·031 mm.; the species is viviparous,* and the uterus and vagina were filled with immense numbers of embryos. Both ends of the body are rounded; on each side of the head a small papilla; lateral fields $\frac{1}{6}$ of the periphery. The embryos are 0·043–0·364 mm. long and 0·0052 mm. broad, relatively very long and slender; the head of the embryo is rounded, the tail pointed, and no internal organs can be distinguished.

Presumably the embryos penetrate into the vascular system of the bird, where they live as blood-filariæ.

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* See "Spolia Zeylanica," part II., p. 28.

EXPLANATION OF PLATES

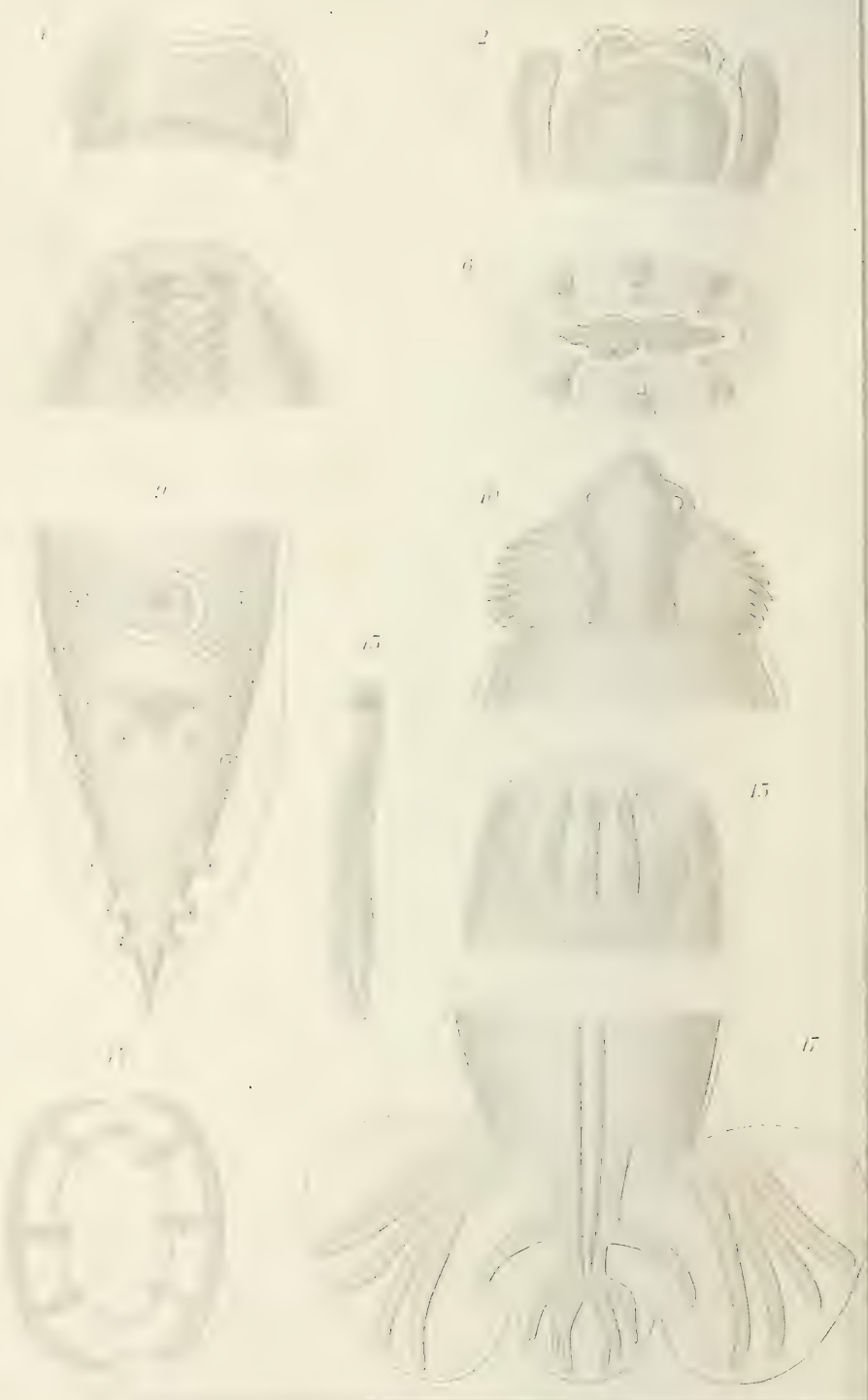
Illustrating Dr. von Linstow's Paper on Nematoda in the Colombo Museum.

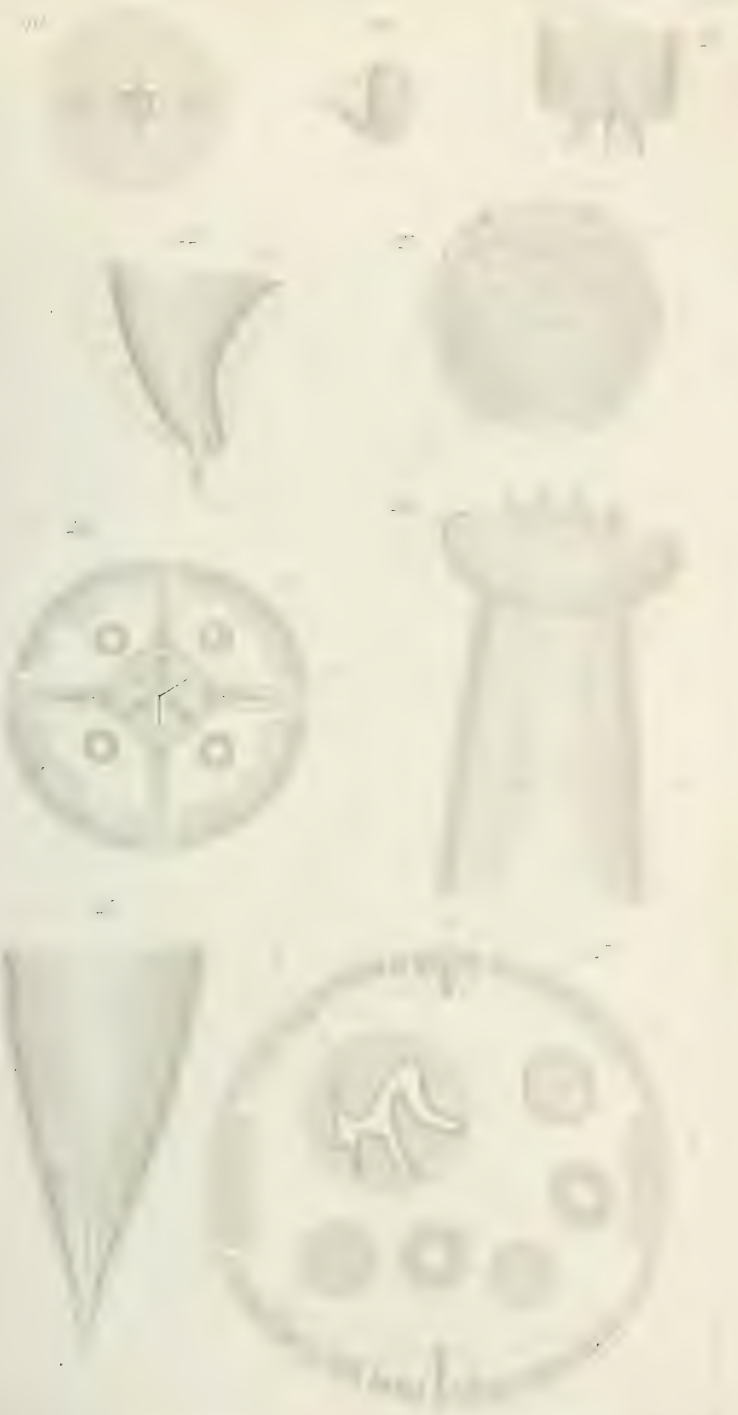
Plate I.

Fig. 1.—*Ascaris rotundicaudata.* Dorsal lip.
Fig. 2.—*A. ceylanica.* Dorsal lip.
Fig. 3.—*A. brachyura.* Dorsal lip.
Fig. 4.—*A. quadrata.* Dorsal lip.
Fig. 5.—*Spiroptera dentata.* Head end from the side.
Fig. 6.—Same. Frontal view of head.
Fig. 7.—Same. Tail end of the male.
Fig. 8.—*Spiroptera triangulum.* Tail end of male.
Fig. 9.—*Heterakis trilabium.* Tail end of male; cirri omitted.
Fig. 10.—*H. anomala.* Head.
Fig. 11.—Same. Tail end of male.
Fig. 12.—*Strongylus pigmentatus.* Bursa of male.
Fig. 13.—Same. Cirrus of male.
Fig. 14.—*Kalicephalus willeyi.* Frontal view of head.
Fig. 15.—Same. Side view of head.
Fig. 16.—Same. Dorsal view of head.
Fig. 17.—Same. Bursa of male.
Fig. 18.—Same. Transverse section of body; *d.* intestine; *s.* lateral field; *g.* lateral vessel or canal.

Plate II.

Fig. 19.—*Oxyuris poculum.* Frontal view of head.
Fig. 20.—Same. A cup-shaped expansion of the duct of the œsophageal glands.
Fig. 21.—Same. Tail end of male.
Fig. 22.—*Oxyuris acanthura.* Tail end of male.
Fig. 23.—*Ctenocephalus tiara.* Frontal view of head; *d.* dorsal lip; *v.* ventral lip; *a.* external orifice of the cervical glands.
Fig. 24.—Same. Ventral view of head; *v.* erected ventral lip; *h.* cervical gland.
Fig. 25.—Same. Tail end of male.
Fig. 26.—Same. Transverse section through the neck region; *o.* œsophagus; *h.* cervical gland.
Fig. 27.—Same. Transverse section through a female; *d.* dorsal tract; *v.* ventral tract; *s.* lateral field; *d.* intestine; *o.* ovary.





NEMATODA - von LINSTOW.

THE CRYSTALLINE ROCKS OF CEYLON.

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THE following Paper is intended to give a brief account of the crystalline rocks of Ceylon, so far as at present known and studied.

The first question which arises is one of nomenclature. For a long time the rocks of Ceylon were somewhat summarily classified as *gneisses*, or as belonging to a "*metamorphic series*." It must here be pointed out that on the Continent the term "*gneiss*" is often used in its strict original sense and applied only to foliated crystalline rocks having the mineral composition of granites, and thus consisting essentially of orthoclase-felspar and quartz, with one or more of the minerals mica, hornblende, or augite. In this strict sense the term "gneiss" is only applicable to certain of the rocks of Ceylon. It has, however, been widely used in England and even abroad to designate rocks characterized rather by the possession of a "gneissose" structure than by any particular mineral composition. In this extended sense the term is applicable to many or most of the rocks of Ceylon.

The name "*granulite*" has been extensively employed to designate foliated crystalline rocks of fine grain in which orthoclase, quartz, garnet, and more or less biotite, hornblende, or augite occur, but which are especially characterized by the presence of garnet.

This term is thus particularly applicable to the majority of Ceylonese rocks, and its use is perhaps to be preferred to that of the term "gneiss."

Mr. Holland has recently named the rock series of Southern India (which closely resembles that of Ceylon) the *Charnockite Series*. Ceylon and Southern India form together a well-marked petrographical province, and there is no doubt that the rocks of Ceylon must be considered as forming part of the charnockite series. It should be noted that the term "charnockite" is used to designate both a whole group of rocks and also one of the types of rock (having particular and definite characters) characteristic of the group. It is thus safest as a general rule to speak of

the foliated crystalline rocks of Ceylon as granulites, and as belonging to the charnockite series of Ceylon and Southern India.

With regard to the use of the term "metamorphic series," it should be recognized that the evidence tends to show that the mass of Ceylon rocks is rather conspicuous for the small evidences of metamorphism subsequent to formation which it affords. The term "metamorphic," embodying as it does a very definite and, generally speaking, erroneous view, is thus to be avoided.

If we come to inquire as to the real nature of the rocks composing the granulite or charnockite series, we are at first struck by the appearances in the field suggestive of a sedimentary origin (figs. 1 and 2). It is not surprising that the conspicuous bedded character, varied mineral composition, and local abundance of alternating beds of limestone should have led to the supposition that such a gneissose series as we have here to deal with really represents the highly metamorphosed remains of some ancient sedimentary series. Closer examination of the rocks, however, reveals but little in support of such a view. Their mineral composition is found to indicate a chemical constitution differing in important respects from that of the great majority of sedimentary rocks, but similar to that of many well-known types of deep-seated igneous rock. Moreover, when we come to examine the minuter characters of the foliation or mineral banding so characteristic of the Ceylon rocks, we see that there is rather a lenticular than a definitely parallel structure (fig. 2), and also that some definite relation is evident between the lighter-coloured (more acid) rock types and those of a darker colour—the more basic.

This definite relationship may show us ovoid lenticular masses of heavy dark rock included in a much lighter-coloured, more acid rock that seems to have flowed around them. In other cases the more acid types give other evidence of their intrusive relation to the more basic bands and lenticles. When the rock examined possesses a general dark colour and basic character we often find the more acid portions existing as irregular patches a few inches or feet in diameter, which send long tongues of acid material in parallel bands along the foliation planes, giving a banded character to a rock which would otherwise present a more uniform appearance. Such phenomena, together with others which a microscopic examination of the rocks reveals, are known to be characteristic of many rocks whose igneous origin is undoubted. It may then be assumed with safety that at least the greater part of Ceylon rocks, so far as at present known, are of igneous origin and that their well-banded appearance (fig. 2) results

FIG. 1.—FOLIATION PLANES IN GRANULITES.

(Charnockite series.) Near Teldeniya, Central Province.

FIG. 2.—FOLIATION IN ROCKS OF THE GALLE GROUP.

(Charnockite series.) Galle Fort. About 7 feet thickness shown.

To face p. 1m.

from the drawing out by flowing movement of the various parts of a heterogeneous magma, probably during its gradual consolidation under conditions of great pressure.

The observed relations of the acid and basic varieties show that the latter types were amongst the earlier products of the magma, the more acid types as usual crystallizing later and having a more or less intrusive relation towards the more basic. The continuous flowing movement accompanying intrusion and consolidation has had the effect of drawing out together in bands the acid and basic types and preventing the former from transgressing the latter in the form of dykes.

No very definite nomenclature can be applied to the different varieties of granulite, which shade insensibly into one another, and are sometimes so intimately interbanded as to make it difficult to collect even a hand specimen of uniform composition. The following general types, however, include the more conspicuous varieties, beginning with the most acid :—

Amongst the rocks of the charnockite series are abundant beds of *granular quartz rock* of very various thickness possessing a mineral composition which varies in different cases from nearly pure quartz, through types containing small quantities of felspar and garnet and sometimes mica, to others which are at once recognizable as the more acid types of granulite. We are thus led to regard the quartz bands as genetically connected with the other members of the charnockite series, and in fact, as the last and most acid products of the magma.

A less acid group is that of the *leptynites*, rocks composed essentially of quartz and felspar (orthoclase microperthite predominating), with or without more or less garnet and biotite and accessory minerals such as graphite, zircon, and apatite. These light-coloured rocks bulk largely amongst the granulites. The *garnetiferous leptynites* are especially conspicuous, the bright red garnets in a nearly white rock giving a very handsome appearance. An especially characteristic feature of some leptynites is the great elongation of the quartz grains.

Many conspiciuous hills (*e.g.*, Bambaragala near Teldeniya, Central Province), with rocky summits weathered into "tors," consist almost entirely of a granular granite-like leptynite composed essentially of quartz and orthoclase microperthite, but often with a small amount of biotite as well. In such cases the rock seems to form a large ovoid mass amongst more basic types.

Typical charnockite consisting of quartz, felspars, and hypersthene has a very different aspect, being of a greenish colour and usually coarser grain, and having a greasy lustre. A considerable

range of types varying much in relative acidity have nevertheless a very similar appearance in the field, and we pass by gradual transitions to rocks having the composition of *norites* (labradorite-hypersthene rock) and *diorites* (hornblende-labradorite rock), &c. Most of these less acid types might also be called *pyroxene granulites*. The most basic types occur chiefly as lenticles and "pinched" bands amongst medium and acid types; they include rocks of which the principal constituents are hypersthene, augite, garnet, basic plagioclase, &c. It is generally more or less evident that these most basic types are to be regarded as amongst the earliest products of the granulite magma.

Rocks of anomalous or unusual composition are sometimes met with, *e.g.*, a felspar corundum rock from near Kandy, and a garnetiferous leptynite in which spinel is very abundant; attention may also be called to the remarkable rocks containing corundum, sillimanite, &c., described by Professor Lacroix. There occur also in the Balangoda district certain zircon granites containing a large quantity of well-crystallized zircon; little is known as to the relations of these rocks; it is not unlikely that they may have some connection with the occurrence of a group of rare minerals (including uraninite, &c.) found in the Balangoda district; they are probably intrusive in the charnockite series.

Pegmatite Dykes, consisting essentially of orthoclase and quartz with mica or hornblende or both, are found occurring as dykes crossing the granulite foliation planes and as sills running along these planes. The pegmatites must be in many cases regarded as segregation veins; they appear to have crystallized before the cooling of the matrix, as the minerals are interlocked at the junction, which is rather a transition than an abrupt junction.

An important series of rocks not yet referred to is that of the *crystalline limestones*. These rocks are found intimately interbanded with the ordinary granulites, the beds of limestone varying in thickness from hundreds of yards down to a few inches. Many varieties are dolomitic, but there is great variation in this respect. Many interesting accessory minerals occur, such as phlogopite, forsterite, graphite, spinel, apatite, amphibole, clinohumite, &c. The nature and origin of these rocks is exceedingly obscure. Many would perhaps regard them as the highly metamorphosed remains of some ancient calcareous sedimentary series included in the vast mass of granulites, and owing their characters to the effects of contact metamorphism. There are, however, great difficulties in the acceptance of such a view. Amongst these may be mentioned the, on the whole, small quantity of the limestone compared with the vast bulk of the

granulites, and the still smaller quantity of other rocks possibly of a metamorphosed sedimentary character, the frequent occurrence in the limestones of fragments of peripherally modified granulite, and the strong general similarity between the characters of the crystallized limestones and those of igneous foliated crystalline rocks.

Putting aside, however, the doubtful question of origin, it is clear that as far as their present characters are concerned the crystalline limestones are contemporaneous with the granulites; and there can be little doubt that they existed in a state akin to fusion at the time of the consolidation of the latter, and that their accessory minerals crystallized under conditions resembling those accompanying the cooling of such plutonic magmas as have for example given rise to the granulites themselves. The foliation of the limestones must have been acquired at the same time and in the same way as that of the granulites.

A group in some respects intermediate between the limestones and granulites includes rocks composed essentially of one or more of the minerals diopside, mica (phlogopite, &c.), amphibole, scapolite, spinel, sphene, and calcite, with more rarely felspars, marcasite, serendibite, &c. In these rocks the silicates are usually idiomorphic when moulded by carbonates. Of the minerals mentioned diopside and mica are predominant. The rocks occur (*a*) as junction rocks between limestone and granulite, (*b*) as inclusions in the limestones, (*c*) as dykes in the granulites, these dykes being usually narrow and having a zoned structure, and (*d*) as bands of rock interbedded with the granulites. Mica of commercial value may occur in rocks of this type. The bands rarely exceed 6 ft. in thickness and are often narrow. Continuity between the types (*c*) and (*d*) can sometimes be observed. Some of the types of rock included here are very handsome, especially the coarse varieties in which scapolite is conspicuous.

Rocks of the *Galle group* are also in some respects intermediate between the limestones and granulites, inasmuch as they contain numerous lime silicate minerals and differ in other respects from the typical granulites, although in many ways resembling them: the presence of wollastonite (not yet found elsewhere in Ceylon) and of scapolite and sphene (in addition to a green pyroxene and the quartz and felspars characteristic of the granulites) and absence of garnet, amphibole, and mica are distinguishing characters of the Galle rocks. As in the granulites, there is a wide range of types, from basic to acid, and mineral banding is very conspicuous (fig. 2).

A brief description of the crystalline rocks is now concluded, but a few other points remain to be considered.

Not a great deal can be said as to the conditions under which the rocks were formed: they must have crystallized under great pressure, and of course the temperature must have been high; during crystallization the magma was probably rather viscous than fluid. There was evidently much flowing movement. The magma was probably far from homogeneous to begin with, and in addition to this the basic minerals crystallized in general before the acid; this heterogeneity combined with movement produced the conspicuous mineral banding. Probably the rocks crystallized at a great depth, the absence of even ancient sedimentary rocks overlying the granulites showing that denudation has long been at work in Ceylon. In India as we proceed southwards the palæozoic rocks die out, and it is probable that the charnockite series is of prepalæozoic or archean age.

Since their formation the rocks have suffered from earth movements, but seemingly not of a violent character, inasmuch as there is little evidence of deformation, nor has evidence of the existence of thrust planes or similar phenomena been noted.

An important series of pressures has thrown the granulites into a main series of anticlinal and synclinal folds, and to this system of folds we may give the name of *Taprobanian;* the axes of the synclines and anticlines, some of which are of great size while others are quite small, have a more or less constant trend about 30° W. of N. in the Kandyan districts, and perhaps more nearly north and south in the Badulla and some other districts; no evidence to date the movements is available.

This structural feature of the mountains of Ceylon is rendered conspicuous by its effect on the directions of river systems and even of roads and railways; every one interested in Ceylonese topography must be acquainted with the north-west and south-east valleys which are so conspicuous and which are due to the rivers cutting their way along the foliation planes of the granulites, forming *strike* valleys*, with corresponding strike ridges separating them. Valleys, usually of less importance, have also been made by streams that have cut their way along the joint planes and thus occupy *joint valleys* oriented approximately at

* The inclination of a rock to the horizontal is termed its *dip*; a line drawn at right angles to the dip on the foliation plane is called the *strike* of the rock; or the strike might be definited as identical with the outcrop on a horizontal surface. In fig. 1 the rocks are dipping from left to right; the water line on the foliation planes serves to indicate the strike. Joints are divisional planes (other than foliation or bedding planes) occurring in a rock, and are usually approximately at right angles to the foliation planes.

right angles to the strike valleys. Sometimes a stream occupies a strike valley for part of its course and a joint valley elsewhere, the change being indicated by a sharp turn. Perhaps the best illustration of the occurrence of parallel strike valleys is found in the Hatton district; in a map of this district the parallel valleys, along which run road and rail as well as stream, are most noticeable (fig. 3).

There are no data available to estimate the actual thickness of the charnockite series in Ceylon (measured in a direction at right angles to the foliation planes), but it is clearly not unlimited, corresponding portions of the series being repeated by the foldings.

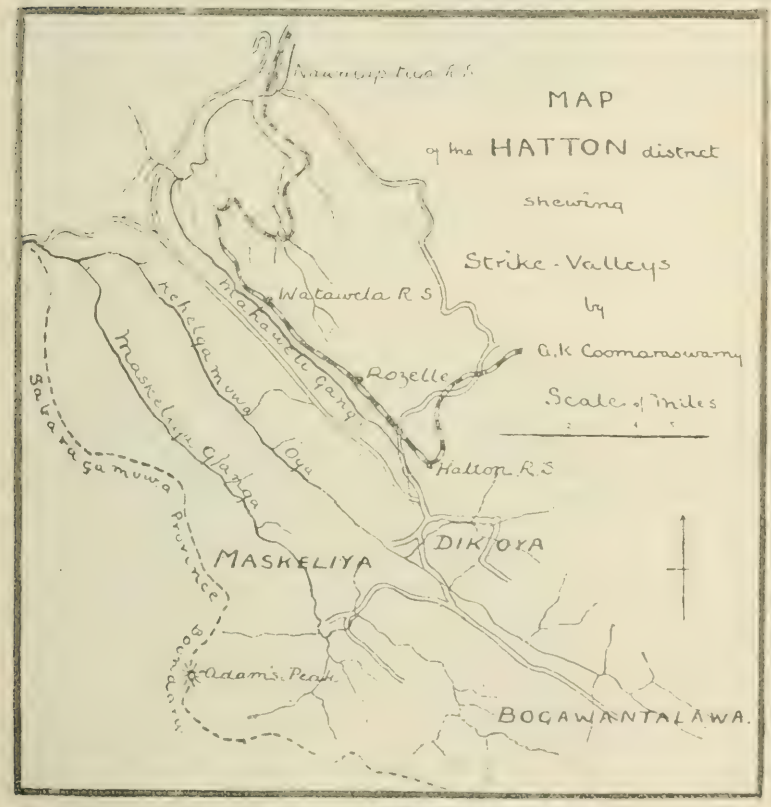

FIG. 3.—STRIKE VALLEYS NEAR HATTON.

NOTES.

1. *Uraninite.*—This mineral (otherwise known as pitchblende) is of considerable interest as being the chief source of radium at the present time, associated with other rare elements. The composition is somewhat variable, but the mineral is usually described as a uranate of uranyl, lead, usually thorium (or zirconium), often the metals of the lanthanum and yttrium groups, with the gases nitrogen, helium, and argon in varying amounts ; radium is present in very small quantities.

A considerable quantity of uraninite in small cubic crystals has been obtained by Mr. R. D. Holland in the Balangoda district, but it is not yet known *in situ* in this area.

×2

Crystal of Uraninite from Ambalawa, Gampola.

It occurs also at Gampola, where it was found on Ambalawa estate by Mr. G. P. Gaddum. It is here found very sparingly, in lustrous sharp-angled cubic crystals in a pegmatite vein traversing granulite. The pegmatite is seen in several boulders on the upper slopes of the Ambalawa estate : the boulders are evidently derived from the hill above. The pegmatite vein consists of quartz, flesh-coloured orthoclase, and biotite (in six-sided crystals), with accessory greenish apatite, black tourmaline, and also uraninite. The uraninite is rather easily recognized by its high specific gravity (exceeding 9·0), black colour, and cubic form. The pegmatite vein does not exceed 14 inches in width, and runs mainly parallel to the foliation planes of the granulites, but sends off branches and tongues which cross the foliation and again run along the foliation planes. The minerals are interlocked at the junction, and there is rather a transition from pegmatite to granulite than a sharp junction. In other words the pegmatite, as is often the case in Ceylon, has rather the aspect of a segregation vein. This occurrence is of considerable interest, as the mineral

has not been previously recorded in Ceylon (there existed a massive fragment in the original Museum collection), and it is to be hoped that the examination of this locality will lead to its discovery in other districts.

A. K. COOMARASWAMY.

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2. *Peregrine Earthworms at Peradeniya.*—A collection of earthworms made by Dr. H. Uzel at Peradeniya in July, 1901, is the subject of a report by Dr. W. Michaelsen* of Hamburg, a copy of which has been courteously forwarded here from the Naturhistorisches Museum at Hamburg. The material consisted of earthworms belonging to twelve species, two of them being described as new. The remarkable feature of this collection is that it is hardly at all representative of the terricoline fauna of Ceylon (which is uncommonly rich), at least nine and perhaps ten of the species being foreign to Ceylon, having been introduced here from various parts of the world, presumably through the mediation of the Botanic Gardens.

Thus about 80 per cent. of Dr. Uzel's collection of earthworms belonged to the fugitive or peregrine element in the Ceylon fauna, and this fact is recorded by Dr. Michaelsen as affording the first numerical basis for estimating the influence of Botanic Gardens in modifying the fauna of a country in certain directions.

A former collection of Ceylon earthworms accumulated by Drs. Fritz and Paul Sarasin was submitted to Dr. Michaelsen† in the year 1887 and was found to comprise twenty-seven species, of which twenty-two were certainly indigenous to Ceylon, only about 15 per cent. being peregrine or introduced. The cause of this difference between the Sarasin and the Uzel collections is attributed by Dr. Michaelsen to the character of the localities, the former having been procured from different parts of the Island, often from districts remote from horticultural intercourse. The acclimatization of useful exotic plants in Ceylon has resulted in the less desirable acclimatization of exotic species of earthworms.‡

The Paper contains a table showing the further distribution of the so-called peregrine species which have been carried to and from such distant provinces as Madagascar, the Philippines, New Zealand, and Central America.

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* Michaelsen, W., Oligochaeten von Peradeniya auf Ceylon, ein Beitrag zur Kenntnis des Einflusses botanischer Gärten auf die Einschleppung peregriner Thiere. S. B. Böhmisch. Ges. Prag, No. XL., 1903, pp. 1–16.

† Michaelsen, W., Die Terricolenfauna Ceylons. Mt. Mus. Hamburg. Bd. XIV. 1887.

‡ *Cf.* Michaelsen, W., Die geographische Verbreitung der Oligochaeten. Berlin. 1903.

The indigenous species obtained by Dr. Uzel are *Plutellus uzeli*, n.sp., and *Pheretima taprobanæ* (Beddard), while *Perionyx ceylanensis*, n.sp., is called doubtfully endemic, being closely allied to a species, *P. sansibaricus*, from Zanzibar.

3. *Rhynchota of Ceylon.*—The order of insects which contains the bugs is called Rhynchota on account of the structure of the mouth-parts, which have the form of a jointed suctorial rostrum formed by the labium, the mandibles, and the maxillæ, modified to form a stylet or piercing organ which is carried bent back under the body when not in use. By means of their stylet these insects are enabled to perforate the epidermis and suck the juices from berries and young shoots. Some are carnivorous, preying upon other insects, and some are ectoparasitic. In mode of life most are terrestrial; a few families are aquatic, and there is a group of pelagic Rhynchota which skim over the surface of the high seas.

The term Hemiptera, referring to the half-coriaceous, half-membranous texture of the wings in many of the families, was formerly applied to the order of bugs, but the name is now superseded by the more comprehensive one Rhynchota, the character of the mouth-parts being of fundamental importance in classification throughout the animal kingdom.

The Rhynchota are divided into two principal sub-orders: the Heteroptera, in which the anterior wings are folded flat upon the back and present a different texture in the basal and apical areas; secondly, the Homoptera, where the wings meet along their inner edges, covering the body like a roof, their texture being commonly homogeneous.

There are some twenty-five families of Heteroptera, of which only the first three are dealt with by Mr. W. L. Distant in the first volume on the Rhynchota-Heteroptera of British India, published in 1902 (Fauna of British India. London, Taylor & Francis).

Statistics relating to the three families referred to are given in the subjoined table:—

Family.	Geographical Area.	Genera.	Species.
I. PENTATOMIDÆ ...	British India (including Ceylon and Burma)	199	542
	Ceylon (total)	51	80
	Do. (endemic)	3	28
II. COREIDÆ ...	British India	45	143
	Ceylon (total)	22	45
	Do. (endemic)	1	14
III. BERYTIDÆ ...	British India	3	4
	Ceylon (total)	1	1
	Do. (endemic)	1	1

Of the fifty-one genera of Pentatomidæ occurring in Ceylon, thirty-seven are represented by single species, or in other words are monotypic in the Island according to existing records. The genus of Pentatomidæ with the greatest number of local species is *Coptosoma*, with seven species, of which five are peculiar to Ceylon. These are small plant bugs somewhat resembling ladybirds (Coccinellidæ) in size, lustre, and general superficial appearance. In the whole of British India fifty-one species of this genus are described by Mr. Distant.

The Coreidæ "closely resemble both in form and position the Longicornia amongst the Coleoptera" (Distant, *op. cit.*, page 331). The family was formerly designated Supericornia on account of the insertion of the 4-jointed antennæ on the upper side of the head. In this sense it may be said that the Supericorn bugs are to the Rhynchota what the Longicorn beetles are to the Coleoptera.

Of the twenty-two genera of Coreidæ in Ceylon thirteen are represented here by single species. The most extensive or polytypic genus in the Island is *Homœocerus*, with eleven species, of which two are peculiar. This genus has thirty-four species altogether in British India.

The only representative of the Berytidæ at present recorded from Ceylon is *Hubertiella cardamomi*, Kirkaldy, a small, slender bug with very long legs, found by Mr. E. E. Green on the under surface of leaves of cardamom (Distant, *op. cit.*, page 424).

The Rhynchota-Homoptera (Cicadas, lantern flies, &c.) of Ceylon form the subject of a recent monograph by Dr. L. Melichar* of Vienna, who obtained his material from various sources, including a large collection made by Dr. Heinrich Uzel, who was recently in the Island. At Dr. Uzel's request the collection of Homoptera in the Colombo Museum was forwarded to Dr. Melichar for the purpose of this work, and was returned by him with names attached to the specimens. The monograph contains accounts of 349 species distributed among 147 genera, including 161 new species and 38 new genera.

The families of the plant lice (Aphidæ) and the scale insects (Coccidæ) also belong to the Homoptera, but are not included in Dr. Melichar's book.

An elaborate and richly illustrated treatise on the Coccidæ of Ceylon has been in course of publication since 1896 under the authorship of Mr. E. E. Green. Two parts, each containing thirty coloured lithographic plates, have been already published (London: Dulau & Co.).

* Melichar, L., Homopteren-Fauna von Ceylon, 233 pages, 6 plates. Berlin (Felix Dames), 1903.

Such of the Rhynchota as are of economic importance in respect of the injury which they inflict upon the tea plant are described in considerable detail in the second edition of "The Pests and Blights of the Tea Plant," by Sir George Watt and Harold H. Mann, Calcutta, 1903: *see* Chapter XIV., pages 247–319.

In this useful volume we are told that "the damage done by the tea mosquito* and the tea green fly† alone probably equals that of all other pests taken together." Nearly forty pages are devoted to the discussion of the attacks of the "tea mosquito" and of the ways in which they may be withstood or prevented. Mr. E. E. Green's discovery‡ of the "hibernation" of the insect on the tea bush itself is quoted and confirmed as an important guide in devising methods of isolation and prevention. During the dormant periods, when the pest is not active, the mature females, which may be found lurking in the bushes by careful searching for them, contain on the average more than half as many eggs again as are found during the attacks, *i.e.*, twelve to thirteen eggs per insect during the dormant periods, as against eight eggs during the periods of attack (*see* Watt and Mann, *op. cit.*, page 269).

With regard to remedial measures the authors come to the conclusion that careful collection of the insects in the early part of the year is the best method of grappling with the evil.

In Ceylon it appears from Mr. Green's observations, quoted by the above-named authors on page 265 of their book, that the periodicity of the insect is subject to fluctuations within the year. In the Kelani Valley, for example, the worst attack takes place in July and August, after which it decreases to a minimum in November, increasing again in virulence until a second though less serious climax is reached in March. After this the pest declines, practically disappearing in May. The recrudescence commences towards the end of June. There are thus two periods of major infestation in March and August, and two minor or quiescent periods in May and November. The March rise coincides with a period of comparative drought, and the August crisis is accompanied by heavy rains (Green, Circ. Roy. Bot. Gardens, 1902, No. 2, page 24).

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4. *Dendrophis bifrenalis*, Boulenger (Rept. Ind., p. 338).—Since reference was made to this tree snake on pages 86 and 87 in

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* *Helopeltis antonii*, Signoret; sub-order Heteroptera, family Capsidæ.

† *Chlorita flavescens*, Fabr. = *Empoasca flavescens* [Melichar, *op. cit.*, p. 215], sub-order Homoptera, family Jassidæ.

‡ Green, E. E., Further Observations on Helopeltis, Circ. Roy. Bot. Gardens, Ceylon, vol. II., No. 2, June, 1902.

"Spolia Zeylanica," Part III., an example of it has been presented to the Museum by Mr. H. M. Drummond Hay, who found it close to his bungalow at Punagalla, Yatiyantota, in November, 1903. Another specimen had been found by Mr. Hay at Hopewell, Balangoda, on a former occasion. It is distinguished from its congeners by the presence of two loreal shields and by the dark olive colouration of the lateral portions of the ventral shields above the lateral keels.

In the letter accompanying this welcome addition to the Museum collection of Ceylon types, Mr. Hay gives interesting particulars illustrating the local distribution of certain snakes. He writes :—"I have had a great many specimens of *Dendrophis pictus* brought to me while I have been here (Yatiyantota), but none of *D. caudolineatus*;" on the other hand, "on Hopewell I found *D. caudolineatus* to be a common snake, and I only came across one specimen of *D. pictus*."

Coluber helena and *Lycodon aulicus*, both frequently taken in Colombo, occur at Yatiyantota, but apparently not at Balangoda; at any rate they were not found on the Hopewell estate, where *Lycodon carinatus* was rather common. The burrowing snake, *Cylindrophis maculatus*, is another species which is often taken in Colombo and other parts of the low-country (*e.g.*, Tangalla, Sigiriya) ranging up to the elevation of Kandy, but was not found by Mr. Hay on Hopewell, though very common on the adjoining estate Allupolla, the highest point of which lies at a lower elevation than 3,000 ft. above the sea, lower in fact than the lowest point of Hopewell.

With the exception of the earth snakes (Uropeltidæ), Mr. Hay found that by far the commonest snake on Hopewell was the poisonous pit viper, *Ancistrodon hypnale*, one of the snakes known as "karawalá" (Sinhalese). Two living specimens of this snake were sent to the Museum in October last by Mr. E. E. Green, who obtained them from Dumbara. One of them died after a few weeks of captivity, but the other survived until near the middle of December, feeding upon insects. It has also been sent to the Museum by Mr. G. G. Ross Clarke from Calsay estate, Nanu-oya, where it is associated with *Dipsas ceylonensis*.

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5. *Symbiosis between Bees and Mites.*—A remarkable instance of symbiosis or special adaptation on the part of a host for the accommodation of its parasite has been brought to light in recent years by two independent observers, Messrs. E. E. Green and R. C. L. Perkins.

The hosts are species of the great black wood-boring bees, very common in Ceylon, of the family Xylocopidæ belonging to the genus *Coptorthosoma*.* This genus is characterized principally by the structure of the basal segment of the abdomen, which fits against the hinder wall of the thorax. This segment is attached to the thorax by a somewhat narrow pedicle below; the rest of the front wall of the segment presents a sharply truncate free border and a concave anterior surface. When the border of the basal abdominal segment is closely applied to the thorax a closed chamber is produced owing to the aforesaid concavity of its front wall. "If," says Mr. Perkins,† "the basal concavity of the first abdominal segment be examined in the female bee, a distinct orifice will be found in the middle, generally small and overhung with hairs, but in some species large and quite exposed."

This orifice leads into a wide chamber which projects backwards, filling a large part of the interior of the segment.‡

The chamber is inhabited by species of mites (Acaridæ), two of which have been named *Greenia perkinsi* and *Greenia alfkeni* by Dr. A. C. Oudemans. Sometimes the acarids are so numerous as to fill the chamber, and occasionally they may be noticed projecting through the orifice. Perkins found the chamber in the females only of seven species of *Coptorthosoma*, namely, *C. latipes*, *tenuiscapa*, *æstuans*, *verticalis*, *cærulea*, *caffra*, and *trepida*. The last two species are from South Africa, the others from the Indo-Malay region.

The fact that the chamber is only found in the female bees is interesting, because "the male bees are short-lived and vagrant, rarely returning to the nest for more than a few days" [Perkins], so that it is an advantage to the parasites to confine themselves to the more stable females. Mr. Perkins, however, found that "not every species of *Koptorthosoma* possesses the chamber, for Dr. Willey has brought home from New Britain females of a species, very closely allied to *K. æstuans*, which show no more trace of it than do the males of those species above mentioned."

Also no species of the genus *Xylocopa* in its restricted sense were found to be provided with an acarid chamber in the female.

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* Sometimes written "*Koptorthosoma*."

† R. C. L. Perkins. On a special acarid chamber formed within the basal abdominal segment of bees of the genus *Koptorthosoma* (Xylocopinæ). Ent. Monthly Mag. (second series), vol. X., February, 1899, pp. 37–39.

‡ A drawing of the chamber showing the position which it occupies in the body of the bee is reproduced in a paper entitled "On some Parasites of *Xylocopa tenuiscapa*, Westw.," by E. E. Green, in Ent. Monthly Mag. (second series), vol. XIII., October, 1902, pp. 232, 233.

Quite recently Dr. Oudemans* has returned to this subject, having ascertained that the existence of an acarid chamber in wood-boring bees had been noticed many years ago.

Of late years, as indicated above, this example of symbiosis was discovered in February, 1898, by Mr. Green, who found it in two species of *Coptorthosoma*, *C. tenuiscapa* and *C. bryorum*, occurring in Ceylon, and sent specimens to Colonel Bingham, the well-known hymenopterist, and to Mr. A. D. Michael, the acarologist in London, but did not publish his discovery. Quite independently, in October of the same year, Mr. Perkins made the same observation and published the paper on the subject quoted above. Dr. Oudemans points out that Mr. Perkins was therefore the "official discoverer" so far as the present incident is concerned.

Dr. Oudemans, however, has since unearthed earlier records of this form of symbiosis in various journals, proceedings, and archives of societies in Holland. In 1856 R. T. Maitland, a Dutch entomologist, described an abdominal sac in *Xylocopa* (*Coptorthosoma*) *latipes* containing acarid parasites, which he named *Gamasus saccicola*. Still earlier, in 1846, a similar instance was described by H. Zollinger, the bee-host being probably referable to *Coptorthosoma æstuans* and the acarid parasite a species of *Trichotarsus*.

Finally, the observation goes back to the year 1839, when Herr Brilman recorded somewhat vaguely the occurrence of mites in the abdomen of wood-boring bees.

Between 1856 and 1898 the phenomenon appears to have been overlooked, a circumstance which illustrates how effectually an interesting and important biological observation may be buried in a publication unless it is followed up and placed in a category with analogous facts drawn from other sources.

END OF VOL. I.

* A. C. Oudemans. Symbiose von Coptorthosoma und Greenia. Eine Prioritätsfrage. Zool. Anz. Bd. XXVII., December, 1903. pp. 137–139. This paper contains further bibliographical references.

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